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EXAMINER	
SMITS, TALIVALDIS IVARS	
ART UNIT	PAPER NUMBER
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/076,120	YANG ET AL.	
	Examiner	Art Unit	
	Talivaldis Ivars Smits	2626	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE ____ MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *19 April 2007*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-28 and 34* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *16 and 17* is/are allowed.

6)☒ Claim(s) *1-15,18-28 and 34* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some.* c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

1. This communication is in response to Remarks, filed 4/19/2007.

Response to Arguments

2. Applicant argues that Janse's spectral subtraction technique is not a "cancellation technique" (p. 12). The examiner begs to differ, since any subtraction of any noise estimate, whether from the noisy signal *waveform* or of the noisy signal *spectrum*, to reduce noise, **is** necessarily a cancellation technique. Applicant does not recite subtracting the correlated noise *waveform*.

Applicant has a better argument when pointing out that Janse does not explicitly teach using a second signal comprised mostly of an undesired component rather than a combination of signal and noise of further unspecified signal to noise ratio value. So the instant Office Action cites Widrow et al. (Adaptive Noise Canceling), who use the notoriously well-known technique of canceling noise in a signal-plus-noise channel by using a reference input corresponding in some way with the noise in said channel as the second signal.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made. .

4. Claims 1-5, 8-11, 13-15, 18-20, 22, 28 and 34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Janse (5,610,991) in view of Widrow et al. (Adaptive Noise Cancelling: Principles and Applications, Proc. IEEE, December 1975).

As to claims 1, 4, and 34, Janse teaches:

a first signal detector configured to provide a first signal comprised of a desired component plus an undesired component, wherein the desired component includes speech (a microphone for receiving speech with noise, col. 3, lines 25-40);

a second signal detector configured to provide a second signal including an undesired component (col. 3, lines 39-44);

a signal processor operatively coupled to the first and second signal detectors and configured to process the first and second signals based on a cancellation technique to suppress correlated undesired component and further based on at least one noise suppression technique to suppress uncorrelated undesired component and to provide an output signal having the desired component and further having the correlated and uncorrelated undesired components suppressed (providing an output signal with the correlated and uncorrelated noise components suppressed, canceling the uncorrelated noise and then applying spectral subtraction to remove correlated noise, col. 5, lines 1-19).

Janse does not teach that the second signal is comprised mostly of an undesired noise component. Widrow et al. teach using such a second sound signal, which necessarily is picked up by a microphone and comprises mostly of noise, and subtracting it from the first signal (a "reference" input containing noise correlated in some unknown way with the primary noise...subtracted from the primary input, Abstract).

It would have been obvious for one of ordinary skill at the time of invention to use such a noise-related second signal in Janse, to more effectively cancel the correlated noise portion from the first signal.

As to claim 2, Janse teaches the first signal detector is a microphone configured to detect speech, (microphone, col. 3. lines 25-40).

As to claim 3, Janse teaches the second signal detector is a sensor configured to detect automobile vibration (a second microphone for detecting a car's various noises, where it would be inherent that since vibration is a car noise, the microphone set to detect a car's various noises would detect vibrations, col. 3, lines 37-40).

As to claim 5, Janse teaches an adaptive canceller configured to process the first and second signals in accordance with a set of coefficients for the cancellation technique to provide an intermediate signal having a portion of the undesired component in the first signal that is correlated with the undesired component in the

second signal removed, and to adjust the set of coefficients using the intermediate signal (a combined speech signal is supplied to an adaptive Wiener filter, where portions of the noise from the various inputs is corrected, col. 3, lines 57-64).

As to claim 8, Janse teaches the adaptive canceller is implemented in a frequency domain (Wiener filter in frequency domain, col. 3, lines 60-65).

As to claim 9, Janse teaches a voice activity detector configured to receive the intermediate signal from the adaptive canceller and provide a control signal indicative of non-active time periods whereby the desired component is detected to be absent from the intermediate signal (detecting pauses in the incoming speech, and providing a signal when the pauses are detected, col. 5, lines 1-11).

As to claim 10, Janse teaches a noise suppression unit configured to receive and process the first and second signal to suppress the undesired component in the first signal and to provide the output signal (signal processing means for removing noise from an incoming signal, Fig. 1, element 11).

As to claim 11, Janse teaches the noise suppression unit is configured to suppress the undesired component in the first signal based on a two-channel spectrum modification technique using the first and second signals (using a multi-channel technique to remove noise from an input signal, col. 3, lines 25-41).

As to claim 13, Janse teaches a noise suppression unit configured to suppress residual undesired component in the first signal based on a status of the voice activity detector (suppression noise based on detected speech in the incoming signal, col. 5, lines 1-15).

As to claim 14, Janse teaches the noise suppression unit is configured to suppress the undesired component in the first signal in a frequency domain (suppressing the noise in a frequency domain, col. 3, lines 40-45).

As to claim 15, Janse teaches installation in an automobile (col. 3, lines 30).

As to claim 18, Janse teaches the desired component in the first signal is speech (the desired component is speech in the first signal, col. 3, lines 27-32).

As to claim 19, Janse teaches:

a first signal detector configured to provide a first signal comprised of a desired component plus an undesired component ((a microphone for receiving speech with noise, col. 3, lines 25-40);

a second signal detector configured to provide a second signal comprised mostly of an undesired component (microphones for receiving mostly noise, col. 3, lines 39-44);

an adaptive canceller configured to receive and process the first and second signals, to suppress a portion of the undesired component in the first signal that is correlated with the undesired component in the second signal, and to provide an intermediate signal (an adaptive Weiner filter for removing noise from the first signal that is correlated with the noise of the second signal, col. 3, lines 58-65);

a voice activity detector configured to receive the intermediate signal and provide a control signal indicative of non-active time periods whereby the desired component is detected to be absent from the intermediate signal (detecting speech pauses in the incoming signal, detecting non-active time periods, where the desired component (speech) is not found in the intermediate signal, col. 5, lines 1-10);

and a noise suppression unit configured to receive the intermediate and second signals, to suppress uncorrelated undesired component in the intermediate signal based on a spectrum modification technique, and to provide an output signal having the desired component and further having the correlated and uncorrelated undesired components suppressed (a noise suppression unit to suppress uncorrelated noise from the signal and to provide the desired component, and having the correlated and uncorrelated undesired components suppressed, col. 5, lines 10-19).

Janse does not teach a second signal comprised mostly of an undesired component. However, Widrow et al. do (a "reference" input containing noise correlated in some unknown way with the primary noise...subtracted from the primary input, Abstract).

It would have been obvious for one of ordinary skill at the time of invention to use such a noise-related second signal in Janse, to more effectively cancel the correlated noise portion from the first signal.

As to claim 20, Janse teaches the adaptive canceller is configured to adaptively cancel the correlated portion of the undesired component based on a linear transfer function (using an adaptive Weiner filter to remove the correlated undesired component, col. 3, lines 55-65).

As to claim 22, Janse teaches the noise suppression unit is configured to suppress the undesired component in the intermediate signal is based on a two-channel spectrum modification technique using the intermediate and second signals (removing the noise form a speech signal using a two-channel spectrum modification technique, col. 5, lines 1-19).

As to claim 28, Janse teaches installation in an automobile (col. 3, lines 30).

5. Claims 6-7 are are rejected under 35 U.S.C. 103(a) as being unpatentable over Janse in view of Widrow et al. as applied to claim 5, above, and further in view of Deligne et al. (6,754,623).

As to claim 6, Janse and Widrow do not teach the adaptive canceller implements a normalized least mean square (NLMS) algorithm.

However, Deligne et al. teach using a popular least means square adaptation or any of its variants (col. 3, lines 40-47).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to combine the methods Janse and Widrow with the least means square method of Deligne et al. to improve the ability for a system to remove ambient noise from speech signals that is acquired through a microphone, as taught by Deligne et al. (col. 1, lines 46-49).

As to claim 7, Janse and Widrow et al. do not teach the adaptive canceller is implemented in a time domain.

However, Deligne et al. teach the adaptive canceller is implemented in a time domain (col. 3, lines 20-25)

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to combine the methods Janse and Widrow et al. with the methods of Janse et al. to improve the ability for a system to remove uncorrelated ambient noise from signals.

6. Claims 12 and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Janse and Widrow et al. as applied to claims 1 and 19 above, and further in view of Pollak et al. (Noise Suppression System for a Car).

Janse and Widrow et al. do not teach a noise suppression unit configured to suppress the undesired component in the first signal based on a single-channel spectrum modification technique using the first signal.

However, Pollak et al. teach one-channel spectral subtraction method (Abstract).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to combine the system of Janse and Widrow et al. with the methods of Pollak et al. because of the robustness, simplicity, and non-musical tone output of the one-channel method, as taught by Pollak et al. (Abstract).

7. Claims 21 is rejected under 35 U.S.C. 103(a) as being unpatentable over Janse and Widrow et al. as applied to claim 19 above, and further in view of Boll (Suppression of Acoustic Noise in Speech Using Spectral Subtraction).

As to claim 21, Janse and Widrow et al. do not teach a system wherein the adaptive canceller is configured to adaptively cancel the correlated portion of the undesired component based on a nonlinear transfer function.

However, Boll teaches a method of bias removal and half-wave rectification, (page 114, section F).

Therefore, it would have been obvious to one of ordinary skill in the art, at the time of the invention to combine the teachings of Janse and Widrow et al. with the

methods of Boll to reduce the noise floor, as taught by Boll (page 115, section F, lines 2-3).

8. Claims 23 and 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Janse and Widrow et al. as applied to claim 22 above, and further in view of Meyer et al. (Multi-Channel Speech Enhancement In a Car Environment Using Wiener Filtering and Spectral Subtraction).

Janse and Widrow et al. do not teach a noise spectrum estimator configured to receive the intermediate and second signals and provide spectrum estimates of the desired component in the intermediate signal and the undesired component in the second signal; a gain calculation unit configured to receive the spectrum estimates and provide a set of gain coefficients, and a multiplier configured to multiply magnitude of a transformed intermediate signal with the set of gain coefficients.

However, Meyer et al. teach:

a noise spectrum estimator (noise floor estimation, page 1169, fig. 3) configured to receive the intermediate and second signals and provide spectrum estimates of the desired component in the intermediate signal (clean speech power spectrum estimated by subtracting current noise power spectrum, page 1169, line 18-19)) and the undesired component in the second signal (current noise power spectrum, page 1169, line 19); and

a gain calculation unit configured to receive the spectrum estimates and provide a set of gain coefficients, and a multiplier configured to multiply magnitude of a transformed intermediate signal with the set of gain coefficients (a frequency domain Wiener filtering necessarily able to determine gain coefficients by which to multiply the FFT magnitude of the noise or voice spectrum page 1169, fig. 3).

Therefore, it would have been obvious to one of ordinary skill in the art, at the time of the invention to combine the teachings of Janse and Widrow et al. with the methods of Meyer et al. to get a improved noise suppression using an algorithm that yields better results in noise reduction with significantly less distortions and artificial noise than filtering alone, as taught by Meyer et al. (col. 1, page 1167, abstract).

9. Claims 26 and 27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Janse and Widrow et al. as applied to claim 19 above, and further in view of Meyer et al. and Boll et al.

As to claim 26, Janse and Widrow et al. do not teach the noise suppression unit is configured to suppress residual undesired component in the first signal based on spectral analysis of the intermediate signal.

However, Meyer et al. teach a spectral subtraction block, speech pause detector, a noise floor estimation block (Fig. 3) where the spectral subtraction technique necessarily works by performing spectral analysis (page 1168).

Therefore, it would have been obvious to one of ordinary skill in the art, at the time of the invention to combine the teachings of Janse and Widrow et al. with the methods of Meyer et al. to get a improved noise suppression using an algorithm that yields better results in noise reduction with significantly less distortions and artificial noise than filtering alone, as taught by Meyer et al. (col. 1, page 1167, abstract).

Janse, Widrow et al. and Meyer et al. do not teach suppression of an undesired residual component in the first signal using the aforementioned intermediate signal.

However, Boll teaches residual noise reduction (residual noise reduction, page 115, column G).

Therefore, it would have been obvious to one of ordinary skill in the art, at the time of the invention to combine the teachings of Janse, Widrow et al. and Meyer et al. with the methods of Boll, to reduce the noise floor, as taught by Boll (page 115, section F, lines 2-3).

Claim 27 is rejected for the same reason claim 23 is above.

Allowable Subject Matter

10. Claims 16 and 17 are allowed. The following is an examiner's statement of reasons for allowance:

As to claim 16, Widrow et al. and Deligne et al. (the closest prior art of record) do not teach nor fairly suggest a two-stage noise cancellation system consisting of a first

noise suppression unit configured to process the first and second signals based on a two-channel spectrum modification technique to suppress the correlated undesired component in the first signal, in tandem with a second noise suppression unit configured to suppress the uncorrelated remaining undesired component in the first signal based on a single-channel spectrum modification technique.

As to claim 17, Widrow et al. and Deligne et al. do not teach nor fairly suggest a two-stage noise cancellation system consisting of a first noise suppression unit configured to process the first and second signals based on a two-channel spectrum modification technique to suppress the correlated undesired component in the first signal, in tandem with a second noise suppression unit configured to suppress the uncorrelated residual undesired component in the first signal.

11. Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

12. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. See PTO-892.

13. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Talivaldis Ivars Smits whose telephone number is 571-272-7628. The examiner can normally be reached on 8:30 a.m. to 5:00 p.m..

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Richemond Dorvil can be reached on 571-272-7602. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

7/12/2007

TĀLIVALDIS IVARS ŠMITS
PRIMARY EXAMINER